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10/500,975	07/08/2004	Chihiro Kawai	50389-052	3373

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EXAMINER	
ARENA, ANDREW OWENS	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/500,975	KAWAI ET AL.	
	Examiner	Art Unit	
	Andrew O. Arena	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 December 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10 and 13-61* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *29-37 and 39-61* is/are allowed.

6)☒ Claim(s) *1-10,13-28 and 38* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-8, 13-22, 24-28 and 38 are rejected under 35 U.S.C. § 103(a) as being obvious in view of Parker (US 4,801,380), Shor (US 5,298,767) and Bohn (US 2002/0074314).

RE claim 1, Parker discloses a filter (col 1 ln 66-68) for filtering, said filter composed of a porous semiconductor device, comprising (e.g., Figs 3-4):

a porous substrate (12) having continuous pores (16); and

a porous semiconductor layer (10) having a light emitting property (inherent property of porous Si, see cited references) by electroluminescence, cathode luminescence, or photoluminescence, and having continuous pores (14),

wherein the porous substrate is a porous ceramic or a metal (col 2 ln 6-15) having continuous pores (16), and

said porous semiconductor layer is provided in on a surface of the substrate.

Parker differs from the claimed invention only in not disclosing the porous semiconductor layer comprises GaN.

Shor teaches a filter composed of a porous semiconductor with advantageous material properties (col 2 ln 40-44 & 59-61) that emits UV (col 1 ln 44-48, col 3 ln 23).

It is well known that UV light kills bacteria and therefore is useful in many filtration applications, e.g., as in Parker and Shor (see cited references not relied upon).

Bohn teaches porous III-V semiconductors having tunable light emitting properties (¶2) and is especially interested in the short-wavelength emission from GaN (¶10) including emitting in the UV (¶14).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify Parker in View of Shor and Bohn such that the porous semiconductor layer comprises GaN; at least because it is known and suitable. See also KSR v. Teleflex, 550 U.S. ___, 127 S. Ct. 1727 (2007).

The resultant device is capable of the intended use "for filtering, sterilizing, and decomposing organic matter" and meets the claim. See MPEP § 2114.

RE claims 2-4 , Parker as modified above discloses the claimed device.

The language "emits ultraviolet light" does not structurally limit the apparatus claim but merely describes what a device does. See MPEP § 2114.

RE claim 5, Parker as modified above differs from the claimed invention only in not expressly disclosing a pn junction structure.

Shor discloses pn junction as claimed (col 4 ln 62-63; Fig 6; col 6 ln 29-33).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify Parker in View of Shor and Bohn such that the

semiconductor layer has a pn junction structure; at least because it is known and suitable. See also KSR v. Teleflex, 550 U.S. ___, 127 S. Ct. 1727 (2007).

RE claims 6 & 13, Parker differs from the claimed invention only in not expressly disclosing a porosity of the semiconductor or the substrate.

One of ordinary skill the filter art must understand that clogging and filter effectiveness are result of varying porosity. See MPEP § 2141.03 citing Hiyamizu.

It would have been obvious to a person having ordinary skill in the art at the time the invention was made that a porosity of the semiconductor layer and a porosity of the substrate is at least 30%; at least to achieve acceptable filtration.

RE claim 7, Parker discloses an average pore size of the porous substrate and/or the porous semiconductor layer is from 0.0003 to 10 μm (col 1 ln 60).

RE claim 8, Parker discloses an insulating layer is formed on a front or back surface of the semiconductor layer (oxide in pore, col 3 ln 30; resin, col 2 ln 16).

RE claim 14, Parker discloses the thickness is a result of varying process conditions (col 4 ln 1-2) and does not particularly limit said thickness (col 4 ln 23-29).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made that a thickness of the porous semiconductor layer disposed on the surface of the porous substrate is from 1 to 1000 μm; as a design choice.

RE claim 15, Parker discloses an average pore size of the porous substrate is from 0.01 to 1000 μm (col 1 ln 60, col 3 ln 46-48).

Parker discloses pore sizes in a range of 0.02 to 0.002 μm as possible (col 1 ln 58-61), even up to 1 μm (col 1 ln 33-35) and does not particularly limit said pore size (col 4 ln 23-29).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made that a thickness of the porous semiconductor layer disposed on the surface of the porous substrate is from 0.01 to 1000 μm; as a design choice.

RE claim 16, Parker discloses a porous semiconductor device for filtering, said porous semiconductor device (col 1 ln 66-68) comprising (e.g., Figs 3-4):

a porous substrate (12) having continuous pores (16); and

a porous semiconductor layer (10) having a light emitting property (inherent property of porous Si, see cited references) by electroluminescence, cathode luminescence, or photoluminescence, and having continuous pores (14),

wherein the porous semiconductor layer [has the structure implied by the recited method steps, i.e., porosity col 1 ln 60, col 3 ln 45-48, which method steps are not required by this apparatus claim, per MPEP § 2113].

Parker differs from the claimed invention only in not disclosing the porous semiconductor layer comprises GaN.

Shor teaches a filter composed of a porous semiconductor with advantageous material properties (col 2 ln 40-44 & 59-61) that emits UV (col 1 ln 44-48, col 3 ln 23).

It is well known that UV light kills bacteria and therefore is useful in many filtration applications, e.g., as in Parker and Shor (see cited references not relied upon).

Bohn teaches porous III-V semiconductors having tunable light emitting properties (¶2) and is especially interested in the short-wavelength emission from GaN (¶10) including emitting in the UV (¶14).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify Parker in View of Shor and Bohn such that the porous semiconductor layer comprises GaN; at least because it is known and suitable. See also KSR v. Teleflex, 550 U.S. ___, 127 S. Ct. 1727 (2007).

The resultant device is capable of the intended use "for filtering, sterilizing, and decomposing organic matter" and meets the claim. See MPEP § 2114.

RE claim 17, Parker discloses the pores (16) in the porous substrate (12) are through-holes perpendicular to a substrate plane (Fig 4).

RE claim 18, Parker discloses an average pore size of the porous substrate is from 0.01 to 1000 μm (col 1 ln 60, col 3 ln 46-48).

Parker discloses pore sizes in a range of 0.02 to 0.002 μm as possible (col 1 ln 58-61), even up to 1 μm (col 1 ln 33-35) and does not particularly limit said pore size (col 4 ln 23-29).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made that a thickness of the porous semiconductor layer disposed on the surface of the porous substrate is from 0.01 to 1000 μm; as a design choice.

RE claim 19, Parker as modified above differs from the claimed invention only in not expressly disclosing a pn junction structure.

Shor discloses pn junction as claimed (col 4 ln 62-63; Fig 6; col 6 ln 29-33).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify Parker in View of Shor and Bohn such that the semiconductor layer has a pn junction structure; at least because it is known and suitable. See also KSR v. Teleflex, 550 U.S. ___, 127 S. Ct. 1727 (2007).

RE claim 20, Parker discloses the columns comprising a base component and a pointed component (pointed in some direction, MPEP § 2111) located on the distal end of this base component.

RE claim 21, Parker as modified above discloses plural electroconductive porous films, one disposed as an electrode (statement of intended use) at the distal ends of the columns.

Parker as modified differs from the claimed invention only in not expressly disclosing another film at the opposite surface of the substrate.

Parker discloses the filtering film on one side of the substrate, it would be obvious to put another film on the other side as well, for example, the allow filtering in both directions. Besides, this is a mere duplication of parts and does not alter device function. See MPEP § 2144.04(VI)(B).

RE claim 22, Parker as modified above discloses plural electroconductive porous films, one disposed as an electrode (statement of intended use) at the distal ends of the columns, and the porous substrate comprises an electroconductive material (Parker: col 2 ln 11) and constitutes another electrode.

RE claim 24, Parker discloses a filter that makes use of the porous semiconductor [device] (col 1 ln 66-68).

RE claim 25, Parker discloses a porous semiconductor device for filtering, said porous semiconductor device (col 1 ln 66-68) comprising (e.g., Figs 3-4):

a porous substrate (12) having continuous pores (16); and

a porous semiconductor layer (10) having a light emitting property (inherent property of porous Si, see cited references) by electroluminescence, cathode luminescence, or photoluminescence, and having continuous pores (14),

wherein the porous semiconductor layer [has the structure implied by the recited method steps, i.e., porosity col 1 ln 60, col 3 ln 45-48, which method steps are not required by this apparatus claim, per MPEP § 2113] a light emitting function on a surface of the porous substrate, and

[can be regarded as being composed of] particles having a particle diameter of 0.01 to 5 μm.

Parker differs from the claimed invention only in not disclosing the porous semiconductor layer comprises GaN.

Shor teaches a filter composed of a porous semiconductor with advantageous material properties (col 2 ln 40-44 & 59-61) that emits UV (col 1 ln 44-48, col 3 ln 23).

It is well known that UV light kills bacteria and therefore is useful in many filtration applications, e.g., as in Parker and Shor (see cited references not relied upon).

Bohn teaches porous III-V semiconductors having tunable light emitting properties (¶2) and is especially interested in the short-wavelength emission from GaN (¶10) including emitting in the UV (¶14).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify Parker in View of Shor and Bohn such that the porous semiconductor layer comprises GaN; at least because it is known and suitable. See also KSR v. Teleflex, 550 U.S. ___, 127 S. Ct. 1727 (2007).

The resultant device is capable of the intended use "for filtering, sterilizing, and decomposing organic matter" and meets the claim. See MPEP § 2114.

RE claim 26, Parker discloses an electrode (conductive substrate can be considered an electrode, col 3 ln 51-52).

The recitation "for injecting current" is a statement of intended use but does not structurally limit the apparatus claim. See MPEP § 2114.

RE claim 27, Parker as modified above differs from the claimed invention only in not expressly disclosing a pn junction structure.

Shor discloses pn junction as claimed (col 4 ln 62-63; Fig 6; col 6 ln 29-33).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify Parker in View of Shor and Bohn such that the semiconductor layer has a pn junction structure; at least because it is known and suitable. See also KSR v. Teleflex, 550 U.S. ___, 127 S. Ct. 1727 (2007).

RE claim 28, Parker discloses a surface of the semiconductor is coated with an insulating layer (oxide in pore, col 3 ln 30).

RE claim 38, Parker discloses a filter composed of the porous semiconductor [device] (col 1 ln 66-68).

Claims 9, 10, and 23 are rejected under 35 U.S.C. 103(a) as being obvious over Parker, Shor and Bohm as applied above, further in view of Robertson (US 4,966,759) and Ogata (US 6,238,631).

RE claims 9, 10 & 23 , Parker differs from the claimed invention only in not disclosing a material having a photocatalytic function.

Shor teaches that porous silicon emits light (col 2 ln 12-14) and also teaches a filter composed of a porous semiconductor with advantageous material properties (col 2 ln 40-44 & 59-61) that emits UV (col 1 ln 44-48, col 3 ln 23).

It is well known that UV light kills bacteria and therefore is useful in many filtration applications, e.g., as in Parker and Shor (see cited references not relied upon).

Roberson and Ogata both teach filtration using a photocatalytic material that is activated by irradiation with light (Roberson, col 6 ln 13-43; Ogata, col 6 ln 40-51).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made that a photocatalytic function be incorporated into the insulating layer; at least to kill bacteria.

Allowable Subject Matter

Claims 29-37 and 39-61 are allowed.

Reasons for allowance are already of record (action dated 02/07/2007).

Response to Arguments

Applicant's arguments filed 12/26/2007 have been considered but are moot in view of the new grounds of rejection.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kurtz teaches that porous Si has a light emitting function (col 1 ln 19-22).

Canham teaches advantages of increased porosity (col 1ln 10-31, col 2 ln 22).

Wilson, Engelhard, and Dempo teach filtration with UV bacteria killing.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew O. Arena whose telephone number is (571)272-5976. The examiner can normally be reached on M-F 8:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lynne A. Gurley can be reached on 571- 272-1670. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Andrew O. Arena/
Examiner, Art Unit 2811
31 March 2008

/Lynne A. Gurley/
Supervisory Patent Examiner, Art Unit 2811